

What is claimed is:

1. A polishing tool for polishing an object, wherein the  
5 polishing tool is comprised primarily by a thermoplastic resin.

2. A polishing tool according to claim 1, wherein the  
polishing tool is a fixed-abrasive polishing tool that contains  
abrading particles within the tool.

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3. A polishing tool according to claim 1, wherein the  
polishing tool is a non-fixed-abrasive polishing pad.

4. A polishing tool according to claim 2, wherein the  
15 abrading particles include cerium oxide ( $\text{CeO}_2$ ), alumina ( $\text{Al}_2\text{O}_3$ ),  
silicon carbide ( $\text{SiC}$ ), silicon dioxide ( $\text{SiO}_2$ ), zirconia ( $\text{ZrO}_2$ ),  
iron oxides ( $\text{FeO}$ ,  $\text{Fe}_3\text{O}_4$ ), manganese oxide ( $\text{MnO}_2$ ,  $\text{Mn}_2\text{O}_3$ ), magnesium  
oxide ( $\text{MgO}$ ), calcium oxide ( $\text{CaO}$ ), barium oxide ( $\text{BaO}$ ), zinc oxide  
( $\text{ZnO}$ ), barium carbonate ( $\text{BaCO}_3$ ), calcium carbonate ( $\text{CaCO}_3$ ), diamond  
20 (C), or a composite material comprised by those recited above.

5. A polishing tool according to claim 1, wherein the  
polishing tool is formed by injection molding to charge a feed  
material under pressure into a mold of a specific shape.

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6. A polishing tool according to claim 1, wherein a material  
comprising the polishing tool further comprises an interface  
activation agent.

7. A polishing tool according to claim 1, wherein a material comprising the polishing tool further comprises a hydrophilic substance or said material is modified by adding the hydrophilic substance.

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8. A fixed-abrasive polishing tool for polishing an object, said polishing tool comprising:

abrading particles; and

a resin for binding said abrading particles in a matrix of said resin, wherein said resin comprises thermoplastic resin.

9. A fixed-abrasive polishing tool according to claim 8, wherein the abrading particles include cerium oxide ( $\text{CeO}_2$ ), alumina ( $\text{Al}_2\text{O}_3$ ), silicon carbide ( $\text{SiC}$ ), silicon dioxide ( $\text{SiO}_2$ ), zirconia ( $\text{ZrO}_2$ ), iron oxides ( $\text{FeO}$ ,  $\text{Fe}_3\text{O}_4$ ), manganese oxide ( $\text{MnO}_2$ ,  $\text{Mn}_2\text{O}_3$ ), magnesium oxide ( $\text{MgO}$ ), calcium oxide ( $\text{CaO}$ ), barium oxide ( $\text{BaO}$ ), zinc oxide ( $\text{ZnO}$ ), barium carbonate ( $\text{BaCO}_3$ ), calcium carbonate ( $\text{CaCO}_3$ ), diamond ( $\text{C}$ ), or a composite material comprised by those recited above.

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10. A fixed-abrasive polishing tool according to claim 8, wherein a porosity is formed in said polishing tool.

11. A fixed-abrasive polishing tool according to claim 10, wherein a range of composition of fixed-abrasives (percentages of abrading particles ( $V_g$ ), binder ( $V_b$ ) and air porosity ( $V_p$ )) in volume percent (vol%) are: 10 % < abrading particles ( $V_g$ ) < 50 %, 30 % < binder ( $V_b$ ) < 80 %, and 0 % < air porosity ( $V_p$ ) < 40 %.

12. A method for making a fixed-abrasive polishing tool comprising:

using abrading particles and a thermoplastic resin as raw materials;

5       filling a forming fixture with a mixture of abrading particles and the thermoplastic resin into a mold; and  
forming the fixed-abrasive polishing tool.

13. A method according to claim 12, wherein said forming  
10 is performed by heating-cooling the mixture and/or pressing the mixture.

14. A method according to claim 12, wherein said mixing of the abrading particles and the thermoplastic resin is carried out  
15 prior to or during filling or after filling a forming fixture with the raw materials.

15. A method for making a fixed-abrasive polishing tool, said method comprising:

20       mixing powdery abrading particles or a slurry and raw materials of the thermoplastic resin to form a dispersion liquid;  
polymerizing or manufacturing the thermoplastic resin; and  
making a mixture containing the polymerized thermoplastic resin and the abrading particles in the dispersion liquid during  
25 the step of polymerizing or manufacturing the thermoplastic resin.

16. A method according to claim 15, said method further comprising:

performing a mist drying step of said polymerized mixture.

17. A method according to claim 16, wherein said mist drying step comprising a spray drying step.

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18. A method according to claim 16, wherein said mixture is formed with particles by the mist drying step and a diameter of the particles is in a range of 1~500 $\mu$ m.

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19. A method for making a fixed-abrasive polishing tool comprising:

mixing abrading particles and a resin in a liquid;

drying said mixed liquid to obtain dried mixed material; and

forming said dried mixed material into the fixed-abrasive

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polishing tool.

20. A method according to claim 19, wherein said abrading particles are provided in a state of slurry.

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21. A method according to claim 19, wherein said resin is provided in a state of powder and mixed with abrading particles in water or a solvent.

22. A method according to claim 19, wherein said resin is provided in a liquid state where the resin is dispersed or dissolved in water or a solvent.

23. A method according to claim 19, wherein said drying step

comprises a mist drying step.

24. A method according to claim 23, wherein said mist drying step is performed by a spray dryer.

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25. A method according to claim 19, wherein said polishing tool is formed by filling the said mixed powder into a mold.

26. A method according to claim 19, wherein pulverizing is  
10 performed to obtain a powder in a range of 1-500  $\mu\text{m}$  during or after  
drying said mixed liquid.

27. A method for making a fixed-abrasive polishing tool comprising:

15           mixing abrading particles and a liquid resin to form a mixed  
liquid;

drying and comminuting said mixed liquid to obtain dried mixed material; and

forming said dried mixed material into the fixed-abrasive  
20 polishing tool.

28. A method according to claim 27, wherein abrading particles are provided as a powder or dried slurry.

25            29. A method according to claim 28, wherein said drying step  
of slurry comprises a spray drying step.

30. A method for making a fixed-abrasive polishing tool

comprising:

mixing powder of abrading particles and a powder of resin  
in a liquid to form a mixed liquid;

drying and comminuting said mixed liquid to obtain dried  
5 mixed material; and

forming said dried mixed material into the fixed-abrasive  
polishing tool.

31. A method according to claim 30, wherein said liquid  
10 comprises water or a solvent.

32. A method according to claim 31, wherein said powder of  
abrading particles is obtained by drying slurry.

33. A method according to claim 32, wherein said drying step  
15 of slurry comprises a spray drying step.

34. A method for making a fixed-abrasive polishing tool  
comprising:

20 mixing slurry containing abrasive particles and a liquid  
resin to form a mixed liquid;

drying said mixed liquid to obtain dried mixed material; and

forming said dried mixed material into the fixed-abrasive  
polishing tool.

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35. A method according to claim 34, wherein said forming  
is performed by molding said dried mixed material into a mold.

36. A method according to claim 34, wherein said drying step comprises a mist drying step.

37. A method according to claim 34, wherein said drying step  
5 comprises a spray drying step.

38. A polishing apparatus for polishing a semiconductor wafer, comprising:

a topring for holding the wafer; and  
10 a polishing tool, said polishing tool comprised primarily by a thermoplastic resin.

39. A polishing apparatus according to claim 38, wherein said semiconductor wafer has patterns comprised by high portions  
15 and low portions.

40. A polishing apparatus for polishing a semiconductor wafer, comprising:

a topring for holding the wafer; and  
20 a fixed-abrasive polishing tool, said polishing tool comprising abrading particles and a resin for binding said abrading particles in a matrix of said resin, said resin comprises thermoplastic resin.

41. A polishing apparatus according to claim 40, wherein a range of composition of fixed-abrasive polishing tool (percentages of abrading particles (Vg), binder (Vb) and air porosity (Vp)) in volume percent (vol%) are: 10 % < abrading

particles (Vg) < 50 %, 30 % < binder (Vb) < 80 %, and 0 % < air porosity (Vp) < 40 %.

42. A polishing apparatus according to claim 40, wherein  
5 said semiconductor wafer has patterns comprised by high portions and low portions.

43. A polishing apparatus according to claim 40, further  
comprising: a dresser for dressing a polishing surface of said  
10 fixed-abrasive polishing tool.

44. A polishing apparatus according to claim 40, wherein  
said fixed-abrasive polishing tool is mounted on a base.

15 45. A polishing apparatus according to claim 44, wherein  
a polishing tool comprised by said fixed-abrasive polishing tool  
and said base is mounted detachably on a polishing table.

46. A polishing apparatus according to claim 45, wherein  
20 said polishing tool is fixed to said polishing table by clamps.

47. A polishing apparatus for polishing a semiconductor  
wafer, comprising:

at least one top ring for holding the wafer; and  
25 at least two polishing tables providing polishing surfaces  
respectively, wherein one of said polishing table having a  
fixed-abrasive polishing tool, said polishing tool comprising  
abrading particles and a thermoplastic resin for binding said



abrading particles.

48. A method of polishing a substrate comprising:

polishing the substrate firstly by a fixed-abrasive  
5 polishing tool, said polishing tool comprising abrading particles  
and a thermoplastic resin for binding said abrading particles; and  
finishing the substrate secondly by a finishing pad.

49. A method according to claim 48, wherein said first  
10 polishing is performed by supplying liquid not containing abrading  
particles.

50. A method according to claim 48, wherein said first  
polishing is performed by supplying water containing additive  
15 agent.

51. A method according to claim 48, wherein said finishing  
step is performed by supplying water.